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CRENOPHYLAX (TRICHOPTERA: LIMNEPHILIDAE), A NEW GENUS TO ACCOMMODATE *RHADICOLEPTUS SPERRYI* BANKS, 1943

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Abstract.—A **new genus**, ***Crenophylax*** (Trichoptera: Limnephilidae), is proposed for *Radicoleptus sperryi* Banks 1943. Diagnostic characters, description, and figures are provided for larva, pupa, and adults.

Key Words: *Limnephilus*, *sperryi*, Arizona, New Mexico, description, figures

Radicoleptus sperryi Banks (1943) has been a source of confusion since its description. The larva, pupa and female have not been described. Banks (1943) described *R. sperryi* from a pair collected in the Arizona White Mountains (M.C.Z. type 25757) and provided a figure of the male. Ross (1944) placed *R. sperryi* in *Limnephilus* but Ross and Merkley (1952) did not include it in their key to *Limnephilus*. Schmid (1955) listed *L. sperryi* as *incertae sedis* within *Limnephilus*. Flint (1966) provided another figure of the male and pointed out the similarity between *L. sperryi* and *Anisogamus costalis* (Banks) but did not recognize Ross' (1944) placement of *A. costalis* in *Psychoronia*. Wiggins (1975) provided rationale for retention of *Psychoronia* for *P. costalis*, but did not address *L. sperryi*. Weaver (1993) indicated the *L. sperryi* type was missing from the Museum of Comparative Zoology.

Crenophylax sperryi is a very rare species. There were no *C. sperryi* specimens reported, other than the types, until Ruiter (1995) refigured the male from a 1962 collection of three males from near Greer, Arizona, which is also in the White Mountains. Houghton (2001) reared a single male from the White Mountains, about 15 air miles southeast of Greer.

This work is based on the above material as well as new material collected by Dean Blinn, Oliver Flint, Jr., and the senior author over the last several years from several localities in the White Mountains, near Greer, Arizona, and about 30 air miles south-southeast of Greer. These collections are all in the Colorado River drainage. The larval association is based on material reared from a single New Mexico locality, about 220 air miles east-southeast from Greer, east of the continental divide in the Rio Grande River drainage. While collections of *C. sperryi* are known from only six localities, it is found, like *Hesperophylax*, on both sides of the continental divide. To date *Psychoronia* is known only from east of the continental divide.

Materials and Methods

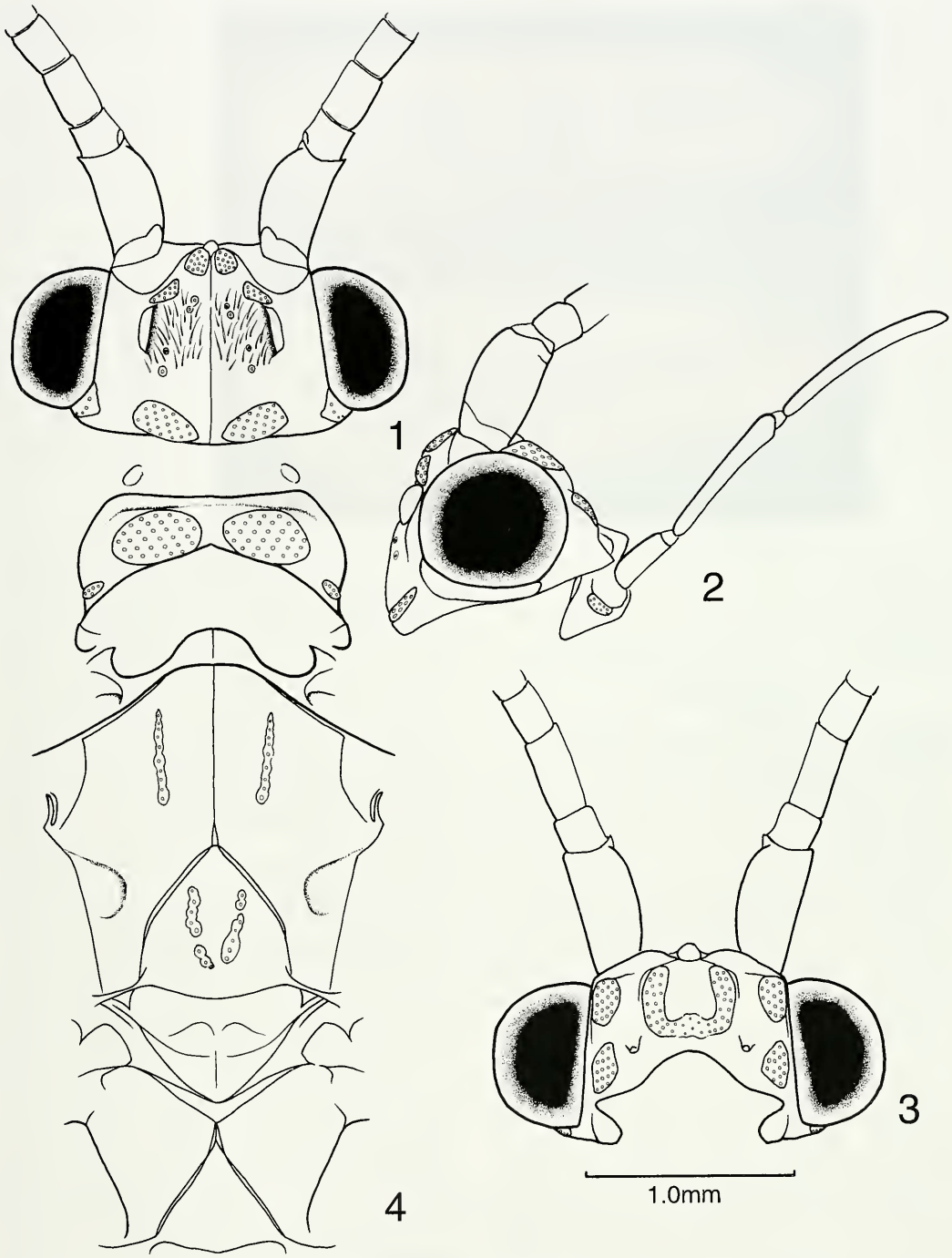
Most of the adults for this study were collected via sweepnet or light. During efforts to locate the female and larva in

the Arizona White Mountains a special emphasis was placed on examination of headwater springs under the supposition that *C. sperryi* larvae are similar to those of *Psychoronia* and *Hesperophylax* (see Ruiter 1995). While occasional adults were collected (see material examined) a larval population was not located until closed pupae, presumed to be *Hesperophylax*, were reared from a New Mexico stream. Larvae and pupae were collected by hand on May 3, 2003, the pupae were placed in a home refrigerator in a jar with a bit of damp moss from the collection locality. Adults started emerging about 60 d later. The larval/adult association is based on comparison of the larval sclerites in the pupal case with those of larvae collected during the original collection. Emergence was halted for several specimens so that mature larvae, pupae and adults were available from the same collection. Material examined in this study is deposited in the collections of Dean W. Blinn (DWB), Canadian National Collection (CNC), National Museum of Natural History (USNM), and the authors (DER) and (HN).

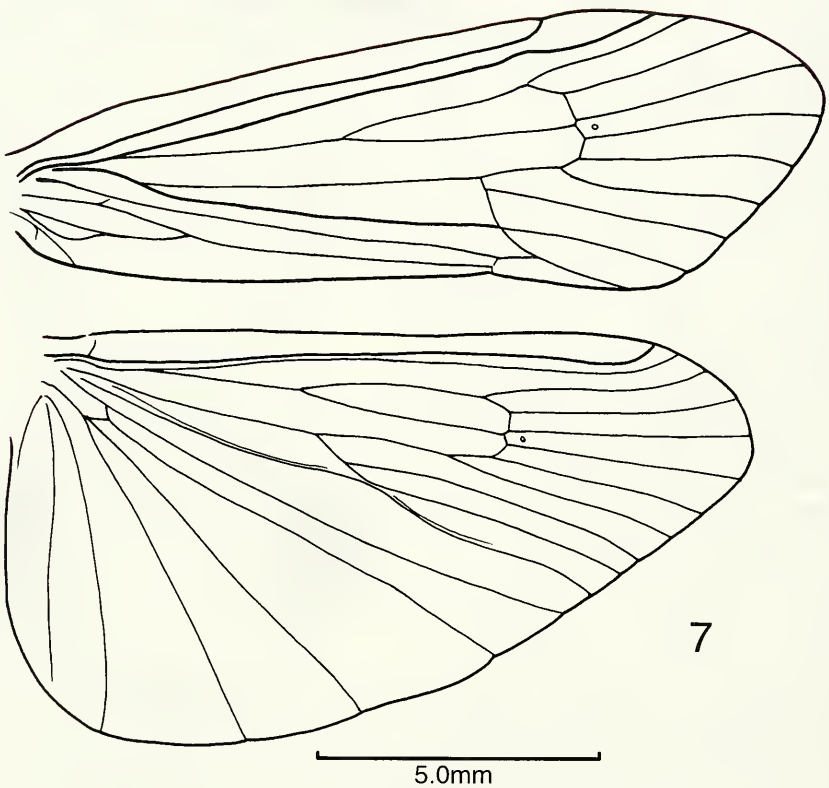
Crenophylax Ruiter and Nishimoto, new genus

Type species: *Radicoleptus sperryi* Banks, 1943.

Adult (Figs. 1–7).—Head yellow; antenna about as long as fore wing, between 60 and 70 segments, scape (Fig. 1) about 3 times length of 2nd segment, 3rd segment about twice length of 2nd, 4th segment about 1.5 length of 2nd segment, remaining segments gradually lengthening to mid-antenna and then gradually decreasing to apex, mid antennal segment length about twice length of 2nd segment; 3 ocelli, lateral ocelli larger than pre-ocellus wart; lateral ocelli located mid-distance between medial suture and eye, located close to anterior margin of head, less than one ocelli length from socket; eye large, width equal to distance between medial suture and eye; medial suture nearly complete, extending anteriorly to anterior margin of ocelli; posterior warts width about 2 times length, covered with 15–20 macrosetae; head surface with numerous small, hairlike setae between and behind lateral ocelli, most setae with small, pale, single, basal warts; maxillary palp three-segmented in male (Fig. 2) and five-segmented in female, male proportions = 0.3:0.8:1, female proportions = 0.3:0.8:1:0.7:0.8; labial palp 3-segmented in both sexes, proportions = 0.3:0.6:1, basal 2 segments flattened ovals, apical segment thin, cylindrical; facial warts (Fig. 3) consisting of two lateral pairs and single U-shaped mesal wart, dorsolateral pair slightly larger than ventrolateral pair; labrum 2.5 times as long as widest portion, widest portion at basal swelling, labial accessory sclerites relatively large, with about 10 macrosetae; postocular wart relatively narrow, widest dorsally, as long as eye height; anterior genal projection present; temporal suture incomplete. Pronotum (Fig. 4) yellow, with two pairs of setae warts, dorsal warts large, oval, with numerous macrosetae; lateral pair small, located at posterolateral apex of pronotum, with 2–6 macrosetae. Mesonotum yellow, with a pair of linear scutal warts, each comprised of 4–8 macrosetae; scutellar setal area with 6–10 macrosetae per side, and a scattering of silky, hairlike setae. Mesopleuron without small setal warts; metapleuron with two setal warts covered in long, silky hairs. Legs yellow, spines black, tibial spurs yellow. Fore- and mesofemora with single, apicomesal, black, spine; hind femur without spines. Tibia and first four tarsal segments with numerous black spines. Foretarsal apical segment without dark spines on ventral surface. Meso- and metatarsal apical segments with 0–2 dark spines on ventral



Figs. 1–4. *Crenophylax sperryi*, adult male. 1, Head, dorsal. 2, Head, lateral. 3, Head, frontal. 4, Thorax, dorsal.



Figs. 5–7. *Crenophylax sperryi*, wings. 5, Male fore wing. 6, Female fore wing. 7, Wing venation.

surface. Male foretarsal proportions = 1:0.5:0.4:0.3:0.3. Female foretarsal proportions = 1:0.6:0.5:0.4:0.4. Tibial spurs highly variable in both sexes; usually 1-2-2 or 1-2-3, often bilaterally inconsistent; evidence of a 1-3-4 spur count usually present with reduced basal pits at point of spur attachment; an occasional specimen (n = 16) with full 1-3-4 complement of spurs. Wing length 13–18 mm (n = 16). Fore wing (Figs. 5,6) 3 times as long as widest portion; brightly contrasted coloration, base color yellowish brown; bright white oval areas in subradial, thyridial, radial, and 5 cells beyond chord; 2–3 white ovals in cell V, occasionally merged to nearly fill cell; 1–2 white circles in discoidal cell; areas around white ovals darker brown; anterior chord nearly black, posterior chord yellowish; setae on veins upright, not particularly strong; setae on wing membrane recumbent, fine, hairlike, same color as underlying membrane, i.e., white on white, brown on brown. Hind wing very pale yellow; setae on veins pale, upright, fine, sparse; setae on membrane pale, recumbent, fine, sparse at base, denser towards apex. Venation (Fig. 7) similar in both sexes; distal margins smoothly rounded. Fore wing with R1–R2 separate throughout length, narrowed and slightly curved at pterostigma; apical forks I, II, III, and V sessile; anastomosis staggered, R3-discoidal cell common boundary slightly longer than t1, less than discoidal cell height; discoidal cell about 1.5 length of RS; t1 linear, about twice length t2; t1 and t2 not parallel; t3 long, originating on Cu1, nearly perpendicular to thyridial cell, curved posteriorly; three anal cells, cells A1 and A3 small, A2 about 0.5 length A1+2+3. Hind wing with enlarged anal area; distal margin at Cu not strongly incised; hooked setae along anterior margin absent; R1–R2 separate throughout length, touching near base, separating towards apex, curved at pterostigma; apical forks I, II, III, and V present, all cells sessile; anastomosis staggered; R3-discoidal cell common boundary equal or shorter than t1, less than discoidal cell height; discoidal cell about twice RS; t1 linear, about equal in length t2; t1 and t2 not parallel; t3 long, originating on Cu1, strongly oblique to wing length; posterior 3 anal cells with long, hairlike setae. Abdomen yellowish; 5th segment gland present, small, oval; ventral processes absent.

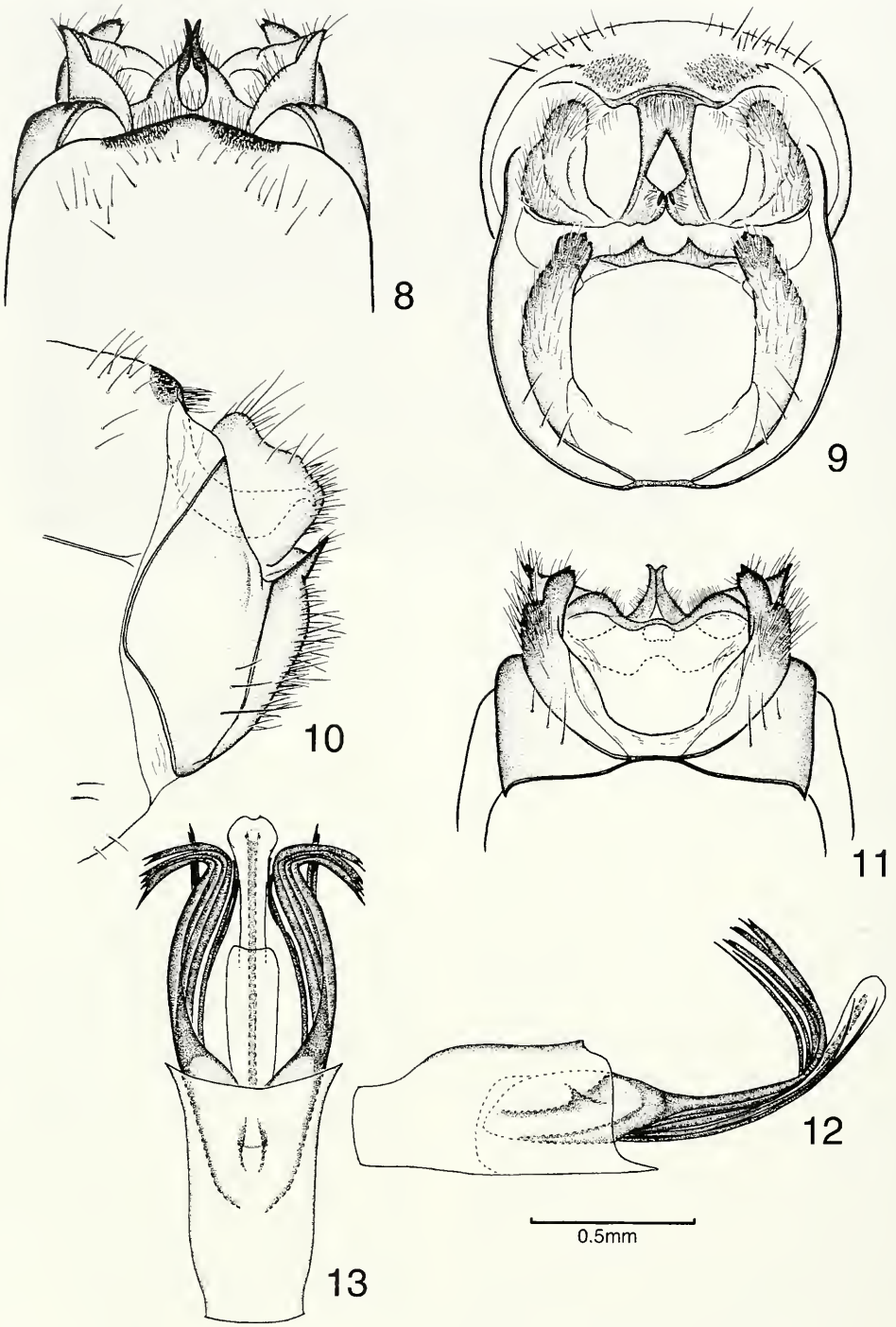
Etymology.—*Crenophylax* (masculine): from the Greek "krene" (spring) and "phylax" (guard), referring to its headwater larval habitat.

Crenophylax sperryi (Banks), **new combination**

Radicoleptus sperryi Banks 1943:346–347, figs. 2, 11, 12. Harvard University, Museum of Comparative Zoology, type No. 25757, types lost. Type locality: White Mountains, Arizona.

Limnephilus sperryi: Ross 1944:298; Schmid 1955:144; Flint 1966:379, 380, figs. 3i, 3j; Ruiter 1995:35, plate 95.

Adult.—*Male genitalia* (Figs. 8–13): Tergite 8 (Fig. 8) with dorsal setae stronger than ventral setae; broad posteromesal spinate patch present; spinate patch broadly concave posteriorly; spines appressed. Segment 9 (Fig. 9) with incomplete, widely separated, tergites; broadest laterally (Fig. 10) at dorsal connection of inferior appendage; connected ventrally by a very thin, sclerotized strap (Fig. 11). Superior appendages nearly quadrate laterally; slightly withdrawn within 9th, widely separated mesally (Fig. 9). Intermediate appendages (Fig. 9) broadly fused dorsally, with dorsal margin distinctly separate from, but touching, 8th tergal spinal patch; appendages broadly concave laterally, reaching mesal margin of superior appendages; ventromesal edges touching, but separate, below anal opening, and

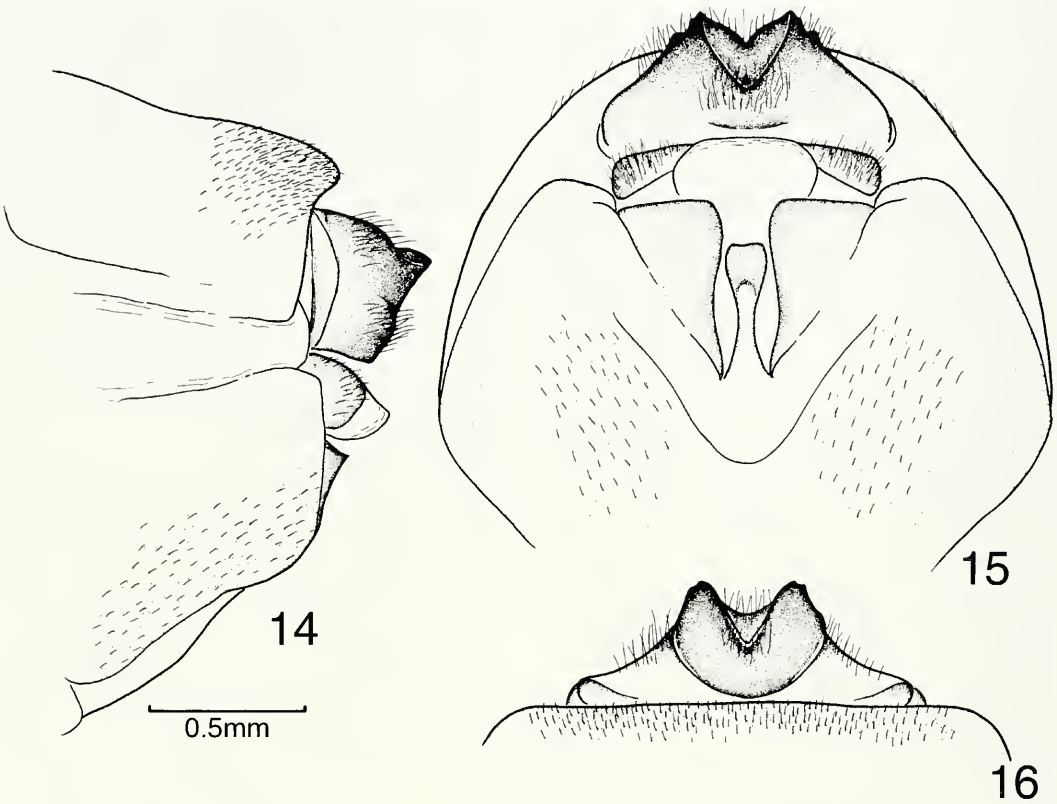


Figs. 8–13. *Crenophylax sperryi*, male genitalia. 8, Dorsal. 9, Caudal. 10, Lateral. 11, Ventral. 12, Phallus, lateral. 13, Phallus, dorsal.

projecting caudoventrally as two, strongly sclerotized hooks. Subanal plate strongly developed, reaching lateral margins of 9th segment; projecting posteriorly nearly to apex of inferior appendages. Inferior appendages broadly separated ventromesally; directed upward; long common boundary with 9th; apex acute, extending caudally equal to superior appendage; in caudal view apex relatively broad with small, acute extension near outer margin. Phallocrypt strips (Fig. 12) sclerotized dorsally, without obvious connection to 9th segment; base of phallocrypt slightly narrower than distal margin. Phallicatal basoventral surface membranous but without linear convolutions; endophallus without endophallic plates; endophallus (Fig. 13) concave dorsally and expanded laterally; phallotremal atrium located dorsally, about midlength of endophallus. Parameres broadly attached laterally to phallicata; apical 3/4ths composed of a broom-like burst of strongly sclerotized, recurved spines; basal, solid portion, a single, undivided, surface with dorsal margin extending beyond ventral margin; spines of paramere reach apex of endophallus.

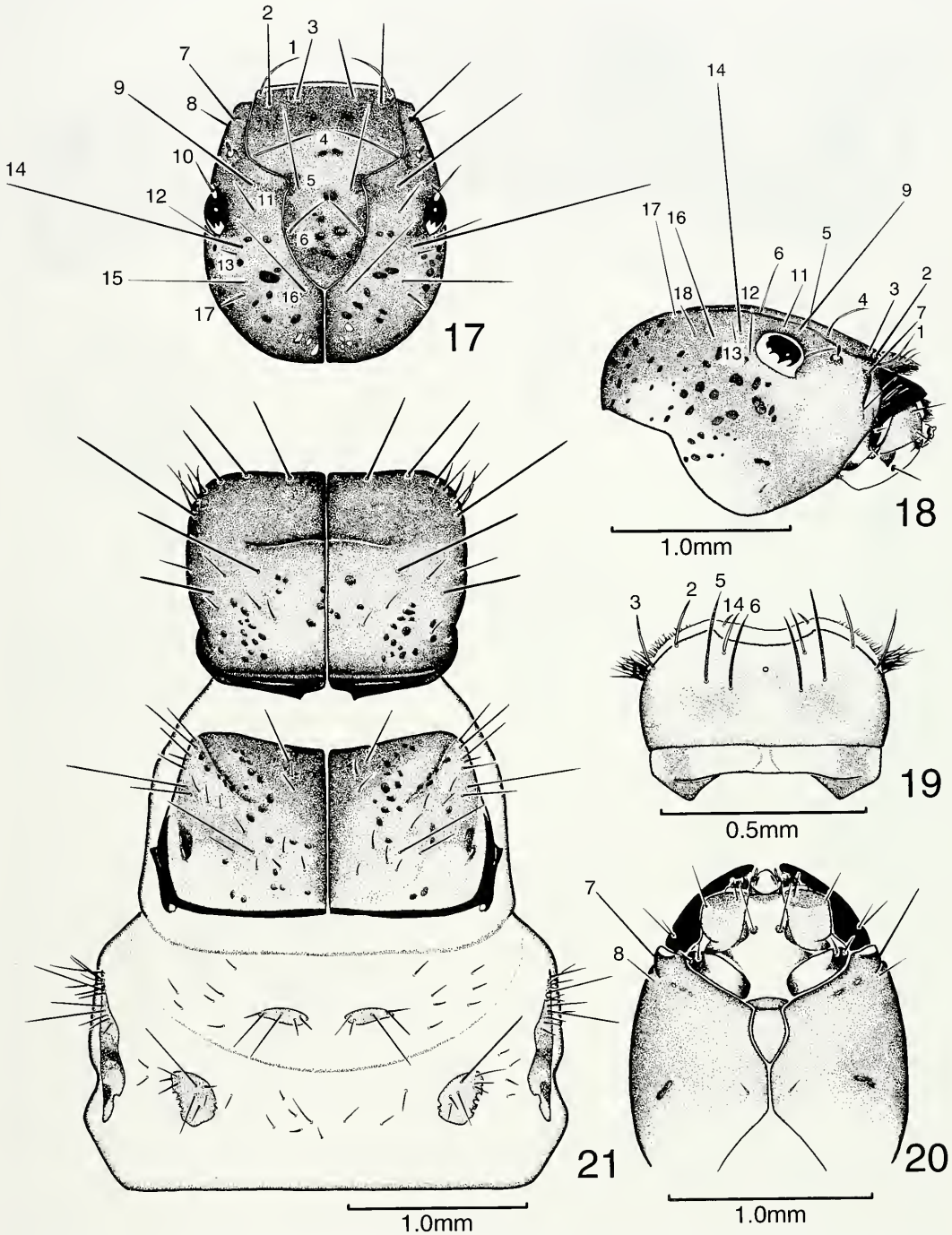
Female genitalia (Figs. 14–16): Segment 8 (Fig. 14) with dorsal setae only slightly stronger than ventral setae. Median lobe (Fig. 15) of subgenital plate about 2/3rds length of lateral lobes; broadest at apex; apical margin slightly concave. Lateral lobes of subgenital plate triangular; broadly connected with 8th segment; wider at apex than base. Subgenital plate broad. Ventral lateral lobes of ninth small, distinctly separated from tergum, widely separated by subgenital plate. Ninth tergum (Fig. 16) narrow dorsally, with slight conical extension between 10th segment appendages; ventrolaterally merged with 10th without obvious suture between two segments. Tenth segment not strongly sclerotized, comprised of a complete cylinder, longer ventrally than dorsally; dorsal lateral appendages fused to tenth, evident by setal patches; short, conical, plates located lateral of anal opening. Spermatheca with spermathecal vestibule narrow, smoothly merged with spermathecal body, without constriction at confluence of vestibule with body; chitinous spermathecal ring tapered, caplike; no constriction below chitinous ring; additional spermathecal gland located about one width of spermathecal vestibule from spermathecal vestibule; entire inner surface of spermatheca with minute sculpturing, without obvious additional markings.

Final instar larva (Figs. 17–25).—Length 13.0–15.0 mm (N = 2). Head (Fig. 17) dark brown; primary setae 1,4, 6, 10, and 16 almost transparent, setae 1,4, 6, 11, 13, 15, and 16 very thin, seta 2, 3, 7, 9 and 14 thickest; setae 2, 3, 5 subequal in length (Fig. 18), setae 9 and 14 extremely long; seta 18 minute. Labrum (Fig. 19) brown, setae 1, 2, 3, and 4 pale, appressed to labrum, about 1/3 length of dark, upright subequal setae 5 and 6. Labial mentum (Fig. 20) consisting of four distinct sclerites; lateral pair triangular, larger than oval, medial pair. Submental sclerites apparently absent. Mandible with scrapping apex. Anterior ventral apotome vase-shaped; widest portion midlength; about twice as long as wide; about 2/3rds length of ventral ecdysial suture. Posterior ventral apotome absent. All surfaces of head and labrum minutely pebbled, with faint spicules on parietal surface at 60× magnification. Muscle scars darker than surface membrane, few present anterior to setae 14, abundant on posterior, parietal surface. Thorax (Fig. 21) slightly lighter than head. Pronotum darker anteriorly; transversely furrowed in apical third; pebbled, without obvious spines or spicules; long macrosetae along anterior margin, with median pair longest, lengths decreasing to shortest at lateral margin; spaced nearly equidistant; setae 22 longest, setae 2 and 3 slightly

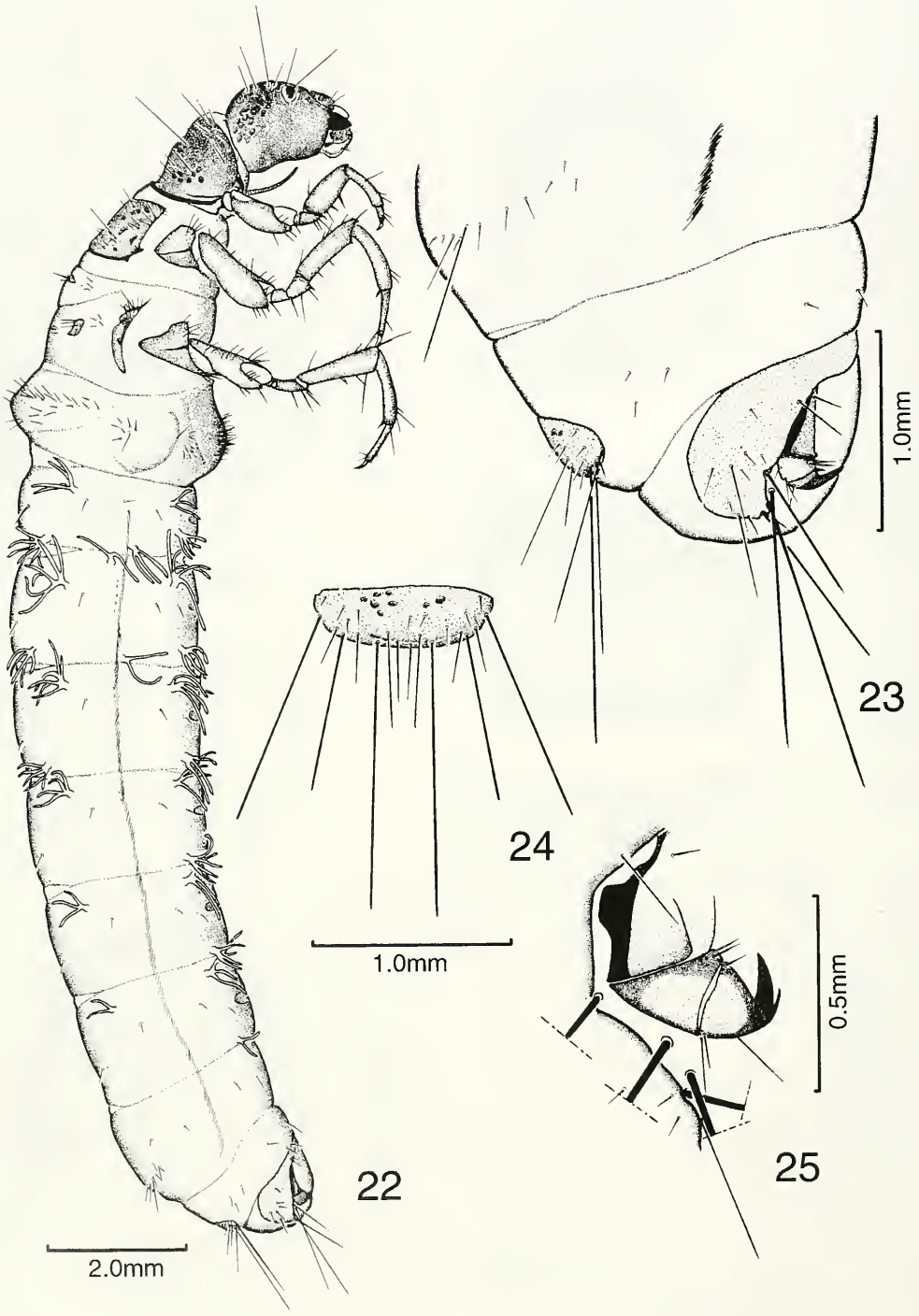


Figs. 14–16. *Crenophylax sperryi*, female genitalia. 14, Segments VIII–X, lateral. 15, Segments VIII–X, ventral. 16, Segments VIII–X, dorsal.

short than 22, all setae dark; muscle scars more obvious posteriorly. Prosternal horn present, about ½ length of coxae. Mesonotum with anterior margin slightly concave; brown, lighter than pronotum; each mesonotal plate slightly wider than long; hind margin black, with blacked area extending anterolaterally to midlength of sclerite; anterior 2/3 portion of mesonotum moderately depressed; muscle scars abundant on anterior half, few on posterior half; setal areas nearly separate. Metanotum with sa1, sa2, and sa3 sclerotized; plate of sa1 linear, plate of sa2 oval. Mesonotal membrane with 10–20 setae around sa1 and sa2. Legs pale brown; trochanters without accessory setae, trochanteral brushes short; femora with only two major setae on ventral edge; profemur with the two major setae hyaline, thickened and flattened, relatively short, distal longer than proximal; mesofemur with hyaline setae located midlength, slightly longer, dark setae located near base of femur; metafemur with hyaline setae located midlength, longer, dark seta located about midway between hyaline setae and apex of femur; lateral surface of all femur without accessory setae; tibial spur count 2-2-2, all spurs hyaline; basal setae of tarsal claw hyaline, relatively stout, about ½ length of claw. Abdominal segment I with 60–80 setae dorsally, 8–10 setae dorsolaterally, 10–12 setae ventrolaterally, 70–90 setae ventrally. Gill arrangement (Fig. 22); most gills with more than 4 filaments; dorsal lateral gills only present at anterior location on segment III, 1 or 2 filaments;



Figs. 17–21. *Crenophylax sperryi*, larva. 17, Head, dorsal. 18, Head, lateral. 19, Labrum, dorsal. 20, Head, ventral. 21, Thorax, dorsal.



Figs. 22–25. *Crenophylax sperryi*, larva. 22, Lateral view. 23, Abdominal segments IX and X, lateral. 24, Dorsal sclerite of segment X, dorsal. 25, Anal proleg, ventrocaudal.

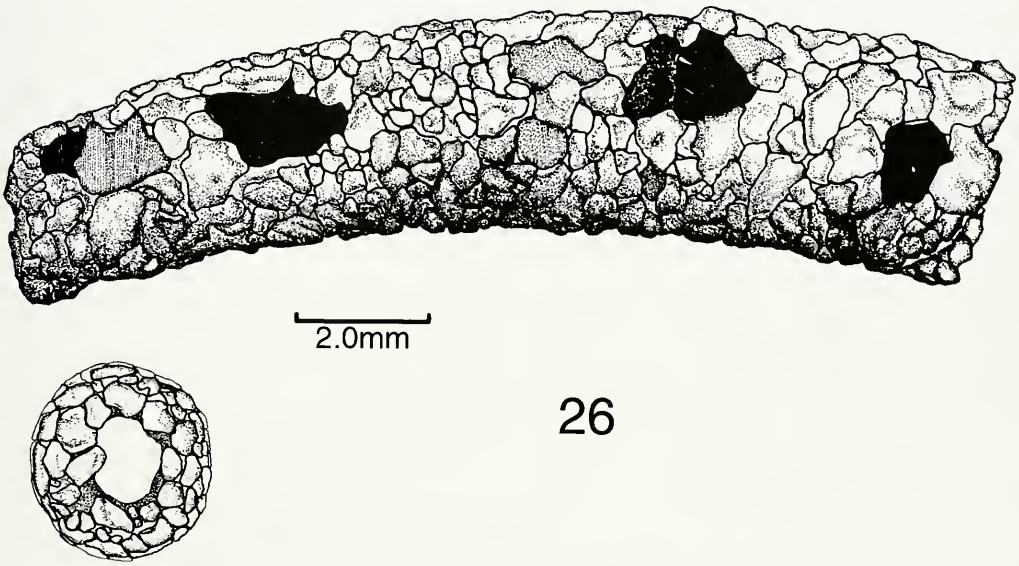
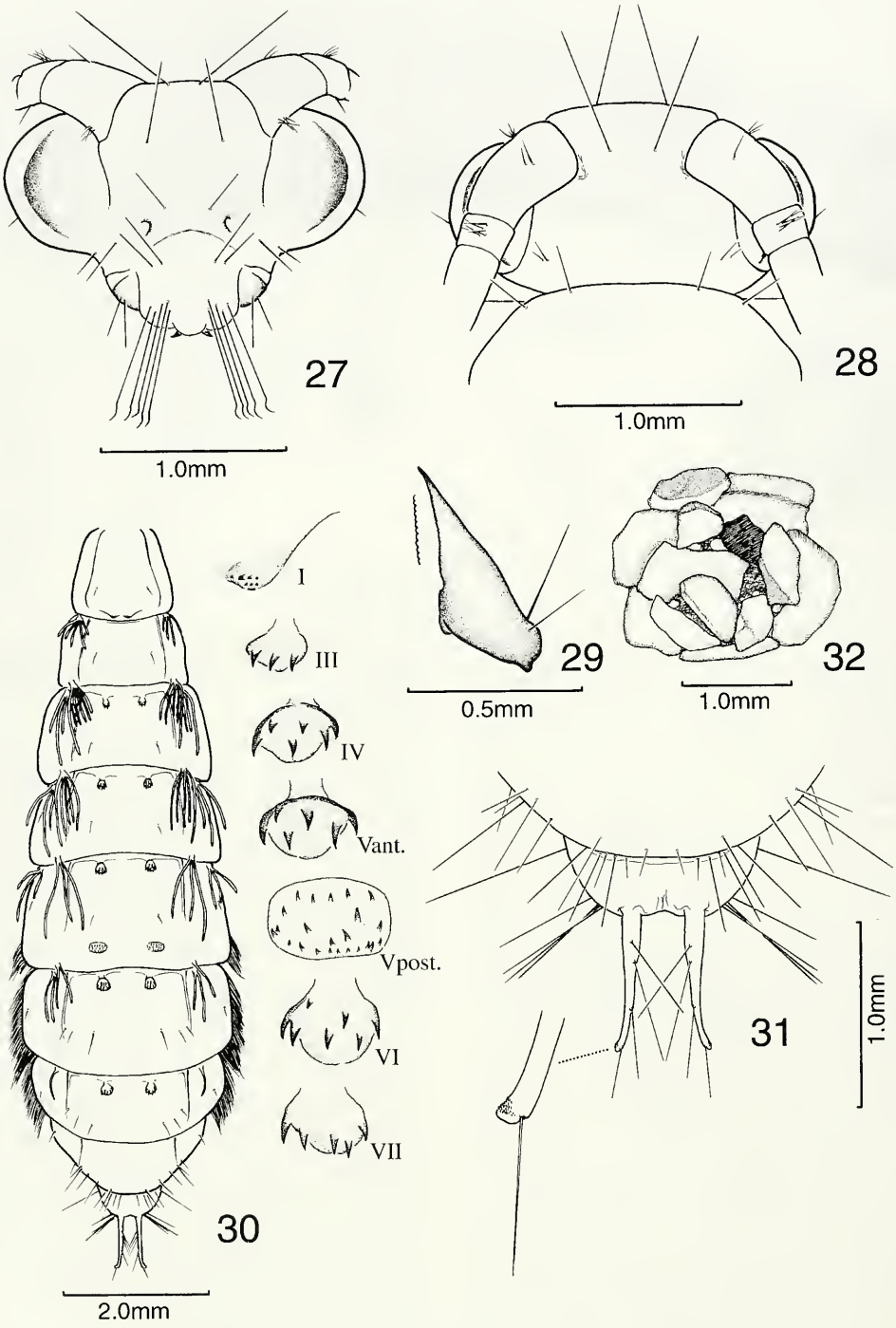


Fig. 26. *Crenophylax sperryi*, larval case, lateral and posterior end, caudal.

ventrolateral series only at posterior location of segments II–IV, usually 2 filaments; dorsal gills end on segment VII, ventral gills end on segment VII. Lateral fringe extends from II thru VIII. Forked lamella on II–VIII, 2–5 on segment II, 1–2 on segments III–VII, 4–6 on VIII. Chloride epithelia present ventrally on II–VII, wide and short. VIII segment dorsal setae black (Fig. 23), 16–20, two long, remainder relatively short. Dorsal plate of segment IX (Fig. 24) yellow, with one pair of very long setae mesally, another pair of relatively long setae laterally, and 16–20 additional short setae, all setae black, no spines present. IX with two pair setae ventrally, mesal pair shorter than lateral pair; dorsolateral setae of IX 1–5. Lateral sclerite of X (Fig. 23) with two long setae on dorsomesal edge in addition to several short setae; no spines present, all setae black. Anal claw (Fig. 25) with a short accessory dorsal hook, hook sometimes absent. Immature case constructed of irregular bark and leaves, slightly tapered posteriorly, slightly curved in lateral view, vegetation surface rough; case changed to mineral particles (Fig. 26) prior to pupation.

Pupa (Fig. 27–32).—Length 14–18 mm (N = 3). Head (Figs. 27,28) with three subequal pairs of short setae on face, one pair located mesally, one pair dorsal of base of mandibles, one pair located at eye margin near mandible; one pair slightly longer setae anterior of antennal bases; longest pair between antennal bases; two short setae posteromesal from each eye; all setae black; labrum with five pairs of long, black, apically hooked setae and one pair of short, hyaline setae; two pairs of black setae in area between head and labrum; antenna with tuft of minute setae near base of pedicel, and 1–2 setae about midlength; tuft of 5–6 setae on second segment, all setae black; mandible (Fig. 29) pointed apically, cutting edge with minute blunt serrations; two black setae at base. Pronotum (Fig. 28) with two pairs of black setae, separated by length of setae. Abdominal hook plates as in Fig. 30. Gills generally arranged as in larva, lateral fringe extending from



Figs. 27–32. *Crenophylax sperryi* pupa. 27, Head, frontal. 28, Head, dorsal. 29, Left mandible, ventral. 30, Abdomen, dorsal. 31, Abdominal segments IX and X, dorsal. 32, Posterior closure of pupal case, caudal.

posterior portion of segment posterior portion of V through VIII. Abdominal segment IX (Fig. 31) with four closely appressed setae ventroapically; a liplike slit ventromesally; 6–10 setae located meso- dorsolaterally; all setae black. Anal processes (Fig. 31) slender, longer than segment IX, each with three hyaline setae located dorsomesally; two closer to base, one near apical 1/3rd, all setae long, basal setae extending too, or beyond apex of process; one black setae at apex mesally, apices directed laterally with small spinules on outer surface. Pupal case consists of mineral particles, larger particles anteriorly; anterior and posterior openings closed by silken membrane with perforations (Fig. 32). Length of pupal case 17–20 mm (N = 3).

Material examined.—ARIZONA: Apache County, at light, Greer, White Mountains, E. & I. Munroe, 05 Aug 1962, 2♂ [CNC] ♂ [USNM]; light trap, West Fork Little Colorado River at Sheeps Crossing, Dean W. Blinn, 20 Jun 2001, ♂ [DWB]; light trap, Little Colorado River at Sheeps Crossing, 7 miles SW of Greer on 273, Dean W. Blinn, 02 Jul 2003, ♂ [DER]; light trap, Hall Creek on Highway 373 near Greer, Dean W. Blinn, 03 Jul 2003, ♂ [DER]; Greenlee County, at light, south tributary to Ackre Lake, D.E. Ruiter, 22 Jul 2001, 3♂ [DER], ♂ [USNM]; at light, north end of Ackre Lake, C.M. & O.S. Flint, Jr., 22 Jul 2001, 2♀ [USNM]; Light Trap, K.P. Cienega, 5.5. miles south of Hannagan Meadows on Highway 191, Dean W. Blinn, 02 Jul 2003, 5♀ [DER] 4♂3♀ [HN]; NM: Lincoln County, North Fork Rio Ruidoso, just upstream from Ski Apache Ski Area, D.E. Ruiter, 03 May 2003, 17 larvae 4 pupae [DER] 5 larvae 2 pupae [HN]; stream, at entrance to Ski Apache Ski Area, D.E. Ruiter, 16 Apr 2004, 38 larvae [DER] ; 6 larvae [HN].

Diagnosis

Banks (1943) placed *sperryi* in *Radicoleptus* Wallengren, 1891, a small Palearctic genus of three species (Morse 2005). Banks (1916) had previously placed the North American species *Limnephilus fumosus*, (Banks 1900) and *Clistoronia* (*Clistoroniella*) *flavicollis* (Banks 1900) in *Radicoleptus* based primarily on the presence of ventral spines on the male last hind tarsal segment, lack of large macrochaetae behind/between lateral ocelli, 1-3-4 spur count, and long hind wing discoidal cell. Banks (1916) also placed *Radicoleptus* (and by inclusion *C. sperryi*) near *Hesperophylax*, and *Psychoronia*. Males of *L. fumosus* group, *C.* (*Clistoroniella*) *flavicollis*, *Hesperophylax* (Banks 1916), *Psychoronia* (Banks 1916), and *C. sperryi* all have the dorsal, sclerotized portion of the 9th tergite very reduced, with either a slightly sclerotized connection (*L. fumosus* group, *C.* (*Clistoroniella*)) or a widely separated, non-sclerotized 9th tergite (*Hesperophylax*, *Psychoronia*, *C. sperryi*). *Hesperophylax*, *Psychoronia*, and *C. sperryi* all have the male intermediate appendages variously fused dorsally. Ruiter (2000) also placed *Hesperophylax*, *Psychoronia*, *C. sperryi*, *Limnephilus fumosus* group, and *Clistoronia*, together based on venational characters. Eurasian *Radicoleptus* males have a very strongly sclerotized male 9th tergite, and many other characters different from *C. sperryi*, *Limnephilus fumosus* group and *Clistoronia* (*Clistoroniella*).

Based on an interesting combination of highly derived characters of the adults and larvae, *C. sperryi* belongs to a group very closely related with *Hesperophylax* and *Psychoronia*. Characters which appear to be apomorphic for the group include the brightly colored fore wings, widely separated male 9th tergites; male phallic paramere consisting of groups of

strongly sclerotized, spiniform blades; male intermediate appendages fused dorsally above the anal opening; most larval gills with more than 4 branches, and larval gill branches originating from basal branches (see Parker and Wiggins 1985 (*Hesperophylax*), Ruiter 1995 (*C. sperryi*), Ruiter 1999 (*Psychoronia*), Wiggins 1996). The origin of the group appears to be in southern North America (Parker and Wiggins 1985).

The presence of the separate subanal plate in male *C. sperryi*, which has variously fused with intermediate appendages in *Hesperophylax* and *Psychoronia*, may indicate *C. sperryi* is the most primitive of the three genera. Parker and Wiggins (1985) interpreted the intermediate appendages of the sister genera *Hesperophylax* and *Psychoronia* as fused dorsally and connected ventrally by a "sclerotized bridge." We interpret the "sclerotized bridge" to be the subanal plate.

The numerously branched larval gills present an unusual limnephilid character which occurs in few other limnephilid genera. *Hesperophylax*, *Psychoronia*, and *C. sperryi* are all associated with extreme headwater/spring portions of streams which may reflect an increase in gill number to accommodate low dissolved oxygen levels. *Ironoquia* and *Lenarchus* also have numerous gill filaments, although of a slightly different structure consisting of relatively shorter, and more numerous filaments. Their habitats may also be expected to have low dissolved oxygen levels.

Male *Crenophylax* can be readily separated from *Hesperophylax* and *Psychoronia* by the presence of the distinct subanal plate resulting in the intermediate appendages not completely fused below the anus. Female *Crenophylax* have a very short, nearly separated mesally, 9th tergite, much shorter than that of either *Hesperophylax* or *Psychoronia*. *Crenophylax* and *Psychoronia* larvae have a pebbled pronotum, lacking the spicules of *Hesperophylax*, although *Crenophylax* has spicules on the head like *Hesperophylax*, which are absent in *Psychoronia*. *Crenophylax* pupa can be separated from *Hesperophylax and Psychoronia* by the presence of long basal setae on the anal processes, which are short, less than 0.5 length of anal process, in *Hesperophylax* and *Psychoronia*.

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Literature Cited

Banks, N. 1900. New genera and species of Nearctic neuropteroid insects. Transactions American Entomological Society 26: 239–259.

———. 1916. A classification of our limnephilid caddice flies. Canadian Entomologist 48: 117–122.

———. 1943. Notes and descriptions of Nearctic Trichoptera. Bulletin of the Harvard University Museum Comparative Zoology 92: 341–369.

Flint, O. S., Jr. 1966. Notes on certain Nearctic Trichoptera in the Museum of Comparative Zoology. Proceedings of the United States National Museum 118(3530): 373–389.

Houghton, D. C. 2001. Caddisfly (Trichoptera) records from the Apache National Forest, eastern Arizona. Entomological News 112: 85–93.

Morse, J. C. ed. 2005, Trichoptera World Checklist. http://entweb.clemson.edu/database/trichopt/.

Parker, C. R. and G. B. Wiggins. 1985. The Nearctic caddisfly genus *Hesperophylax* Banks (Trichoptera: Limnephilidae). Canadian Journal of Zoology 63: 2443–2472.

Ross, H. H. 1944. The caddis flies or Trichoptera of Illinois. Bulletin of the Illinois Natural History Survey 23(1): 1–326.

Ross, H. H. and D. R. Merkley. 1952. An annotated key to the Nearctic males of *Limnephilus* (Trichoptera, Limnephilidae). American Midland Naturalist 47(2): 435–455.

Ruiter, D. E. 1995. The adult *Limnephilus* Leach (Trichoptera: Limnephilidae) of the New World. Bulletin of the Ohio Biological Survey, New Series, Volume 11, Number 1.

———. 1999. A new species and new synonym in the genus *Psychoronia* (Limnephilidae), with significant records for caddisflies (Trichoptera) from Western North American. Great Basin Naturalist 59(2): 160–168.

———. 2000. Generic key to the adult ocellate Limnephiloidea of the Western Hemisphere (Insecta: Trichoptera). Ohio Biological Survey, Miscellaneous Contributions Number 5, 22 pp.

Schmid, F. 1955. Contribution à l'étude des Limnophilidae (Trichoptera). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 28: 1–245.

Wallengren, H. D. J. 1891. Skandinaviens Neuroptera. Andra afdelningen. Svenska Akademien Handlingar 24(10): 173 pp.

Weaver, J. S. III. 1993. The Trichoptera of the Museum of Comparative Zoology, Harvard University. Braueria 20: 33–50.

Wiggins, G. B. 1975. Contributions to the systematics of the caddisfly family Limnephilidae (Trichoptera). II. Canadian Entomologist 107: 325–336.

———. 1996. Larvae of the North American Caddisfly Genera (Trichoptera). 2nd Edition. University of Toronto Press, 457 pp.